Benzodiazepine Use and Criminal Activity: A Case-Crossover Study

Hannah P Lethbridge

BA Psychological Science (Hons)

A report submitted in partial requirement for the degree of Master of Psychology (Clinical) at the University of Tasmania

Statement of Originality

I, Hannah P Lethbridge, declare that this research report is my own work and that, to the best of my knowledge and belief, it does not contain material from published sources without proper acknowledgement, nor does it contain material which has been accepted for the award of any other higher degree or graduate diploma in any university.

……

Hannah P. Lethbridge

Dated: 12th November 2019

Acknowledgements

First and foremost, I would like to thank my thesis supervisor Associate Professor Raimondo Bruno for his knowledge, expertise, and unwavering support during the writing of this thesis. Without his dedication to this study and ongoing assistance in problem solving statistical challenges, this project would not have been possible. Bruno consistently encouraged me to have autonomy in my own work but guided me throughout the research process.

I would also like to thank Suzanne Nielsen, who was responsible for coordinating data collection for this project in 2011. She has been a sounding board in the development of this study at all stages.

I would like to acknowledge the support the University of Tasmania has provided me throughout all stages of my Master's degree and research project process. The facilities and resources have allowed me with all the tools I needed to successfully complete this project.

I would like to express gratitude and thanks to the subjects who participated in this study. Without them, the research would not have been possible.

Finally, I would like to thank my peers for their unwavering support and assistance during the many challenges experienced throughout this research process. The friendships and bonds I have formed are unforgettable and I am grateful for the opportunity to study and research alongside so many passionate individuals. I would also like to thank my family, friends, and partner for their continuous support and encouragement in helping me to stay motivated to accomplish my goals.

Table of Contents

List of Tables

List of Figures

Abstract

The relationship between drug use and crime has been well-established in the literature among groups of illicit recreational substances. There is a paucity of literature investigating the misuse of prescribed pharmaceutical drugs and their contribution to the drug crime link. Benzodiazepines are a class of prescription anxiolytic drugs commonly used to treat anxiety. A small body of research suggests that the misuse of high potency benzodiazepines (e.g., alprazolam) can be positively associated with criminality. The current study aimed to examine the relationship between benzodiazepine use and criminal activity among a sample of 82 offenders. A case-crossover design was utilised whereby substance use in the 12-24 hours prior to a crime event (hazard period) was compared with substance use in the 28 days prior to the same crime event (control period). Incidence Rate Ratios were calculated using multilevel mixed-effects negative binomial regression models to determine if there was an increased likelihood that benzodiazepine use in the hazard period was associated with criminal activity. After controlling for baseline alprazolam use, demographics, psychosocial factors, and general crime engagement, participants were 62% more likely to commit a crime if they had used alprazolam in the hazard period, *IRR* = 1.62, 95% CI [1.17-2.24], $p = 0.003$. There were non-significant positive associations between diazepam, other illicit substances and criminal activity and non-significant negative associations between methadone, temazepam, and criminal activity. These findings suggest there may be a strong and unique positive association between alprazolam use and criminal activity. This has important implications for individuals who are prescribed alprazolam or taking the drug recreationally within an offending population, as consumption may place them at greater risk for criminal engagement. This research also has implications for the ease of access to alprazolam prescriptions.

Benzodiazepine Use and Criminal Activity: A Case-Crossover Study

The relationship between drug use and crime has been well-established in the literature among groups of illicit recreational substances (e.g., amphetamines, heroin, cocaine; Bennett, Holloway, & Farrington, 2008). A systematic review of drug use prevalence among prison populations found that illicit drug abuse and dependence were reported in 10%-48% of males and 30%-60% of females (Fazel, Bains, & Doll, 2006). Additionally, it was estimated that the societal cost of problematic drug and alcohol use in Australia for the 2004/2005 financial year was 23.5 billion dollars (Collins & Lapsley, 2008). Furthermore, of all prisoners incarcerated for violent crimes, approximately 24% of offences were attributable to illicit drug intoxication. Recent research has also indicated that there is a strong and positive association between the use of methamphetamines, heroin, and cannabis and acquisitive offending, due to an increased need to finance further drug use (Goldsmid & Willis, 2016). While it is difficult to establish a causal link between drug use and crime, some literature suggests the two may occur in parallel due to a third factor (e.g., a mental health condition; Seddon, 2000). For example, Swartz and Lurigio (2007) found that individuals who used substances alongside a diagnosis of a serious mental health condition were placed at an increased risk of being arrested for a crime. Attempting to investigate the acute triggers for drug use and associated crime will contribute to a better understanding of the drug-crime link. The majority of drug-crime literature has focussed on the use of illicit substances. There is currently a paucity of literature investigating the misuse of prescribed pharmaceutical drugs, like benzodiazepines, and their contribution to the drug-crime link.

Drug Use and Offending Behaviour

A large body of existing literature suggests that individual's dependent on illicit drugs are disproportionately involved in criminal activity; particularly acquisitive and property related offending (Pierce et al., 2015). The aetiological mechanisms involved in the drug-

crime link remain unclear. Several theories have been posited in an attempt to explain the relationship between drug use and criminal behaviours. One of the most well-known theories is Goldstein's (1985) tripartite framework, in which he specifies three ways that drug use and crime interact. Firstly, the forward causation component suggests drug use causes crime through either the need to fund further drug use or due to the physiological changes precipitated from the drug use itself (i.e., the individual becomes disinhibited; Bennet et al., 2008). Secondly, the reverse causation component suggests that criminal involvement leads to drug use due to an increased opportunity to use drugs among crime circles (Hammersley, Forsyth, Morrison, & Davie, 1989). Lastly, the confounding component suggests there is no causal link between drug use and crime, rather they co-occur due to a common set of causes (i.e., a concomitant mental health condition, impulsivity, or socio-economic deprivation; Seddon, 2000). It is generally accepted among researchers that there is not a single sequential or causal relationship between drug use and criminality, but rather a complex association between the two (Gossop, Marsden, Stewart, & Rolfe, 2000). It is also accepted that the relationship between drug use and crime will vary between individuals due to individual differences, and within individuals over time due to changing situational factors (e.g., obtaining stable accommodation or being rehabilitated).

Although well known, the tripartite model has been criticised for lack of emphasis on the importance of psychological processes, social context, and the development of the drug-crime relationship over time (Curtis & Wendel, 2007). In recent years the literature has refocused on understanding the patterns of involvement in drug use and crime separately, as opposed to just establishing a link between the two (Riordan, 2017). These recent theories suggest that certain individual traits underpin careers in drug use and crime (i.e., career criminals; DeLisi & Piquero, 2011). The criminal careers paradigm suggests that regardless of childhood experience (e.g., childhood impulse control; childhood propensity towards

crime) persistence and desistance towards criminality is shaped by the strength of meaningful social connections developed throughout life (DeLisi & Piquero, 2011). Protective factors like stable relationships, employment, and financial stability are seen to change the trajectory of criminal involvement in a positive way (Sampson & Laub, 2003). Sampson and Laub (2003) investigated the influence of alcohol and illicit substances on the criminal careers' paradigm. Their findings suggested that over the course of a lifetime alcohol contributed to both persistent and episodic patterns of offending. They also found that alcohol and drug use undermined the strength of positive social connections with others, which contributed to further offending.

Acquisitive Offending. Historical research indicates that the regular and dependent use of drugs like heroin and cocaine is associated with income-generating crimes (e.g., acquisitive offending; Speckart & Anglin, 1985). The current study defines acquisitive offending as any offence that is committed to achieve a financial gain (Pierce et al., 2015). Jarvis and Parker (1989) found that heroin users were more likely to be charged with acquisitive offences to fund further heroin use over other types of crimes (e.g., assault, joy riding, and criminal damage). Additional studies have demonstrated that the onset of addictive drug use is also associated with an increased likelihood for criminal involvement which continues throughout the period of addiction (Ball, Shafter, & Nurco, 1983). Intoxication also seems to increase engagement in property-related offending (Sutherland et al., 2015).

A study conducted by Goldsmid and Willis (2016) investigated the criminal motivations of a group of Australian police detainees. Researchers compared results between detainees who used methamphetamines (n = 410) and those who did not (n = 736). The results indicated that those who used methamphetamines derived a significantly higher proportion of their income from crime than those who did not use. Logistic regression

analysis determined that methamphetamine, heroin, and cannabis use positively predicted engagement in acquisitive offences. Regression models also found that intoxication and funding further drug use played an integral role in the committing of property-related crimes. This research may have been compromised by detainees underreporting their involvement in crimes to avoid implicating themselves in offending that police were unaware of. Researchers also suggested the reported percentages of drug use were conservative estimates, due to participant social desirability bias.

Further studies have suggested that drug intoxication may contribute to engagement in violent crimes as well. Research has suggested that acquisitive crimes committed by drug users typically decrease following the implementation of drug treatment interventions. Perpetrators of violent crimes may differ from other drug-related offenders and have varied treatment needs due to contrasting criminal motivations. Given the significant societal impact that violent offences have on the community, understanding the criminal motivations and possible influence of drug use on violent offending is important.

Violent Offending. Violent crimes, including physical assault, homicide, manslaughter, violent sexual assaults, or serious threats cause significant harm to society. Violent offending is defined as any crime that utilises intentional force or power, threatened or actual, against another person, a group, a community, or property that has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation (Krug, Mercy, Dahlberg, & Zwi, 2002). Research indicates that among substance using populations displaying criminal behaviours, a significant minority of deaths are caused by physical assault from others (Ericsson, Bradvic, & Håkansson, 2014). Violent crimes among this population are also known to be associated with various psychiatric problems including substance use disorder (Falk et al., 2014). Substance use disorder is also one of the strongest predictors of violence in early adulthood (Moberg et al., 2015). Additionally, amphetamines,

alcohol, and polysubstance use have been found to serve an important role in the commission of violent crimes. Further research investigating the mechanisms involved in this relationship is important, both to inform therapeutic intervention and aid in harm reduction to increase community safety.

A recent cohort study conducted by Pierce et al. (2017) investigated the relationship between opioid initiation and violent crimes. Participants were individuals who tested positive for opiate and cocaine metabolites as recorded by the Drug Test Record (DTR) between April 2005 and March 2009. Contrary to studies that have found an increase in violent crimes among opiate using populations, this study demonstrated a decrease in violent offending by men and no apparent increase in violent offences conducted by women after opioid initiation. These results are consistent with previous findings that revealed a null result between increased violence and opioid initiation, which may support the use of opioid replacement programs (i.e., Fiellin, Friedland, & Gourevitch, 2006; Parker & Auerhahn, 1998; White & Gorman, 2000). Although the study contributes to important research about opioid initiation and crime, there was evidence of some misclassification between cases who tested positive to opioids and those who tested negative. This could have been attributed to the use of a saliva test, which only detects metabolites consumed in the 24 hours prior to testing. The saliva tests may not have detected less-problematic use and as such miscategorised opiate users as non-users, leading the results to be overly conservative.

Sommers and Baskin (2006) investigated the association between methamphetamine use and violence, by using life history interviews. The sample comprised of (N = 205) individuals who had used methamphetamines for a minimum of three months. Findings indicated that 26.8% of the sample had committed methamphetamine-related violence while intoxicated (i.e., 80 isolated reports of violence). Approximately 30% of males and 23% of females had engaged in violence while using methamphetamines. The study indicates that

methamphetamines have the potential to exacerbate an individual's risk of violence while intoxicated. All interviewees agreed that methamphetamine use is associated with violence and abuse potential, however there was not a singular pattern of abuse trajectory among participants (i.e., the subjects experiences ranged from controlled use to addiction). Findings also suggested that while there is a heightened risk of violence when using methamphetamines, violence is not an inevitable outcome of methamphetamine abuse. Although providing an important contribution to drug-crime literature, consideration must be given to the impact of self-report bias on data collection as participants may have underreported their engagement in crime or substance use.

Although the two preceding studies have conflicting findings, it may be a result of the different physiological changes precipitated by the two drug types (i.e., depressant versus stimulant) as opposed to their being a null relationship between some illicit drugs and violent crimes. These relationships may also be influenced by confounding factors (e.g., mental health conditions/polydrug use).

Mental Health, Drug Use, and Criminality

Mental health issues have been implicated as another factor involved in the drug-crime nexus. Historical literature has demonstrated a strong and positive association between mental health concerns and propensity to commit crimes, as manifested by overrepresentation in prison populations and higher arrest rates among individuals with mental health issues (Fazel & Danesh, 2002; Teplin, 1990). A 12-month prevalence study conducted by Butler et al. (2006) revealed that the Australian prison population had significantly higher psychiatric morbidity than the general population, 80% versus 31%, respectively. Although this indicates a clear positive relationship between mental health issues and offending behaviours, the underlying nature of this relationship is poorly understood. Despite this, the role of substance use is becoming more widely accepted (Junginger, Claypoole, Laygo, & Crisanti, 2006).

Australian statistics indicate that among prisoners, illicit drug use is more common in individuals with high psychological distress than in individuals with low psychological distress (Forsythe & Adams, 2009). Illicit drug use is also more common among prisoners who are medicated for a mental health disorder (75%) as opposed to those who are not medicated (66%). Among prison entrants diagnosed with a mental health condition, nearly half disclosed their substance use contributed to their offending (Sweeney & Payne, 2012). When considering the increased prevalence of mental health conditions among prisoner populations, there has been an increased interest in the relationship between criminal activity and the misuse of prescribed pharmaceutical drugs, particularly benzodiazepines (Forsythe & Adams, 2009; Monheit, 2010).

Benzodiazepines and Offending Behaviour

Benzodiazepines are a type of prescription anxiolytic drug commonly used to treat anxiety and insomnia (Albrecht, Staiger, Hall, Kambouropoulos, & Best, 2016; Wain, Khong, & Sim, 2007). In Australia, there is an elevated rate of benzodiazepine prescribing, which is cause for concern given evidence of significant nonmedical use, abuse and other harm (Jones, Nielsen, Bruno, Frei, & Lubman, 2011). This also persists despite better long-term outcomes from psychological as opposed to pharmacological interventions (e.g., Baldwin et al., 2014; Gould, Ott, & Pollack, 1995; Yoon, Slade, & Fazel, 2017); and high rates of relapse following discontinuation of use (Morin, Belanger, Bastien, & Vallieres, 2005; Noyes, Garvey, Cook, & Suezler, 1991).

Although typically associated with sedative effects, benzodiazepines can be associated with paradoxical reactions including aggression, anger, and hostility (Jones et al., 2011). While most single dose studies demonstrate low prevalence for these paradoxical effects, animal and human studies have demonstrated a positive correlation between benzodiazepine use and aggression (Wallace & Taylor, 2009). Specifically, Daderman and

Lidberg (1999) conducted a mixed methods study among a sample of male juvenile offenders (N = 19) and found that, flunitrazepam (rohypnol) and alcohol use was associated with planned grievous violence more severe than usual violent offending. The effects of flunitrazepam intoxication are largely associated with increased strength and self-esteem, reduced fear and insecurity (particularly related with punishment of violent acts), and a distorted sense of reality. As a result, researchers found that offenders had a reduced ability to experience anger, fear, and sadness, and had difficulty empathising with, or feeling guilt/remorse for their victims. Participants subjectively reported these side effects as desirable. These behaviours were observed in already violent individuals which may indicate that benzodiazepines exacerbate violent tendencies when used in conjunction with other substances. Particularly, benzodiazepines that are short-acting and are likely mediated by dose and environmental factors. The findings should be interpreted with some caution as there may be an increased risk of subjectivity and researcher bias impacting on the qualitative components of the results. Despite this, these paradoxical effects may further contribute to understanding the nature of the relationship between benzodiazepine use and criminality among offenders.

A longitudinal study conducted by Comiskey, Stapleton, and Kelly (2012) found that among a sample of inpatients and outpatients (N = 404), those who had not committed a crime at intake where eight times more likely to have committed an acquisitive crime at one year follow up if they were using benzodiazepines regularly. This level was higher than individuals who were regularly using cocaine. A further study found that among a group of individuals recently released from prison (N = 141) there was a strong and positive relationship between illicit benzodiazepine use and the commission of property crimes. National data has also found strong positive associations between benzodiazepine misuse and the occurrence of criminal activity (Fry, Smith, Bruno, O'Keefe, & Miller, 2007). Smith,

Miller, O'Keefe, and Fry (2007) investigated the relationship between benzodiazepine misuse and crime among injecting drug users in a Victorian sample. Results indicated that more than 50% of the sample had engaged in property related crimes to procure the drug (e.g., burglaries, forged prescriptions). Property crimes were found to be most highly associated with the use of benzodiazepines (alprazolam) and heroin. Violent crimes were found to be most highly associated with benzodiazepines combined with another drug. Therefore, polydrug use including benzodiazepines may exacerbate violent tendencies.

Benzodiazepines, Polysubstance use, and Offending Behaviours

Michel and Lang (2003) emphasised the importance of distinguishing between individuals who experience paradoxical reactions to benzodiazepines idiosyncratically and those who voluntarily seek disinhibition. Their research focussed on a sample of individuals who had consumed benzodiazepines and found that participants were more likely to voluntarily seek disinhibition. Researchers suggested it is unlikely that any benzodiazepine independently produces these adverse reactions; rather that dose, polysubstance use, and psychopathology interact to produce hazardous psychological states (Michel & Lang, 2003).

Specifically, alcohol seems to play an integral role in the onset of these paradoxical responses (Weerts & Miczek, 1996) due to the synergistic effects of alcohol and benzodiazepines on the central nervous system. Benzodiazepines have been known to have a great propensity to interact with alcohol, resulting in marked disturbances to psychomotor coordination (Kurzthaler et al., 2005). Other known side effects include reduced executive functioning (i.e., poor consequential thinking), memory loss, increased violence, inhibition of fear and disruption of threat detection resulting in increased risk-taking behaviours (de Geus, Denys, & Westenberg, 2007; Kurzthaler et al., 2005). Benzodiazepines can also impair episodic memory and metacognition, in that individuals have a reduced awareness of their own thought processes and behaviours. This could lead to the commission of crimes driven

by drug-induced memory failure. Some studies have also demonstrated that the combined effects of benzodiazepines and alcohol can trigger criminal activity (Haggard-Grann, Hallqvist, Langstrom, & Moller, 2006). Results indicated that individuals were approximately 13 times more likely to engage in violent behaviours within 24 hours of alcohol and benzodiazepine use in high doses. Contrastingly, regular doses of benzodiazepines were associated with decreased criminality. This suggests that the regular and prescribed use of benzodiazepines may be protective. However, when individuals engage in polysubstance use and binging behaviours, they are placed at an increased risk of criminal engagement and exacerbation of violent tendencies (Michel & Lang, 2003). One benzodiazepine of interest is alprazolam, which when used recreationally can be associated with increased criminality (Albrecht, Staiger, Hall, Kambouropoulos, & Best, 2016).

Alprazolam Use and Offending Behaviour

Alprazolam (Xanax) is a short acting benzodiazepine commonly prescribed to treat, anxiety, panic disorder, and depression (Hegel, Ravaris, & Ahles, 1994; RACGP, 2015; Verster & Volkerts, 2004). In recent years, the clinical use of alprazolam has been a point of contention, given the addictive nature of the drug, severe withdrawal syndrome, and its high potential for misuse (Ait-Daoud, Hamby, Sharma, & Blevins, 2018). Alprazolam remains to be one of the most commonly prescribed benzodiazepines. Examinations of United States national emergency department (ED) visit data from 2011 has found that alprazolam is the most common benzodiazepine to be involved in ED visits that are related to drug misuse (SAMHSA, 2013). Historical research investigating the abuse liability of alprazolam has found that in comparison to other equipotent benzodiazepines (e.g., oxazepam), in individuals with a history of alcohol, opiate, or other drug dependence, alprazolam was preferred as the effects were more rewarding (Ciraulo et al., 1997). Similarly, in a small double-blind study (N = 14) among benzodiazepine users, alprazolam was preferred to diazepam in a drug choice

test (Apelt, Schmauss, & Emrich, 1990).

The high potential for abuse is thought to be attributed to the unique pharmacokinetic properties of the drug. Specifically, alprazolam has properties of rapid absorption, a short half-life, low lipophilicity, and high potency (Ait-Daoud et al., 2018). Like all addictive drugs, alprazolam alters the mesolimbic dopaminergic reward pathway in the brain. Some studies suggest that subjectively alprazolam produces more euphoria than other benzodiazepines (e.g., Iguchi et al., 1989). This may lend itself to increased risk of addiction when used for long periods of time. Independent evidence suggests that alprazolam may be associated with some unusual psychopharmacological effects in rats. Specifically, Bentue-Ferrer et al. (2001) found that alprazolam uniquely affected the dopaminergic function of the striatum (e.g., a brain structure implicated in motivation and reward) in rats in a similar way to stimulants, despite being a depressant drug. This suggests that alprazolam has a unique ability to interact with the dopaminergic mesolimbic reward pathway. Based on this, the elevated level of benzodiazepine prescribing is cause for concern.

Albrecht et al. (2016) found that among a sample of reported benzodiazepine users, alprazolam predicted increased general and physical aggression. Anecdotal suggestions also indicate that alprazolam use is associated with increased criminality soon after use due to the high potency and short-acting nature of the drug (Rapaport & Braff, 1985), however little research has been conducted to this effect. Some studies have shown that alprazolam is associated with poor/risky decision making as well as novelty seeking on personality scales (e.g., Lane et al., 2005). Experimentally, there is some evidence to suggest that alprazolam is associated with increased aggression in humans (Bond, Curran, Bruce, O'Sullivan, & Shine, 1995) and in mice (Votava et al., 2001) both on its own and when used in conjunction with alcohol (Bond & Silvieri, 1993). However, to date there is very little research examining the association between alprazolam use and criminal activity. The current study aims to rectify

this existing gap in the literature, by investigating the relationship between alprazolam misuse and criminality (i.e., acquisitive and violent) by way of case-crossover design.

Current Study

There is a small body of literature suggesting that benzodiazepines, particularly high potency forms (e.g., alprazolam) are associated with criminality. However, the reasons for use and motives for offending remain to be fully investigated or understood. This is likely attributed to the difficulty in isolating the role of benzodiazepine use in a criminal population due to the increased presence of extraneous factors. For example, the presence of polysubstance use, engaging in criminal behaviours to fund further drug use, and demographic factors (e.g., low socio-economic status, psychological distress, social and familial context) may increase the likelihood of criminal involvement. By utilising a case-crossover design, the relationship between benzodiazepine use and acute triggers for crime can be investigated while reducing the influence of extraneous factors, as participants act as their own controls. Case-crossover designs draw a comparison of exposures (i.e., benzodiazepine use) immediately prior to a hazardous event (i.e., crime) and a control event (i.e., general functioning). No research to date has utilised a case-crossover design to examine the relationship between benzodiazepine (alprazolam) use and crime among offenders.

Aims and Hypotheses. The current study aimed to examine the effects of benzodiazepine use upon the occurrence of criminal activity. A case-crossover design was utilised with cases being a sample of offenders who use benzodiazepines. The study aimed to compare benzodiazepine use, specifically alprazolam in the 12-24 hours prior to a crime event (hazard period) with general alprazolam use (control period). Based on aforementioned research, the following predictions were made:

H1. Recent benzodiazepine use will be associated with the commission of a crime (i.e., greater odds of use in the hazard period than the control period).

H2. Alprazolam use in the hazard period will be more strongly associated with criminal activity than the use of other benzodiazepines in the hazard period.

H3. Recent other drug use will be associated with the commission of a crime in the hazard period over the control period.

H4. Alprazolam use in the hazard period will be associated with a greater likelihood of engagement in violent crimes over acquisitive crimes. It is not anticipated the same association will be seen in the use of other benzodiazepines.

Method

Participants

Participants were recruited from various Drug Diversion Services at the Melbourne Magistrates Court (MMC) and Dandenong Drug Court (DDC) in metropolitan Victoria. The MMC offers two drug diversion programs including: 1) the Court Integrated Services Program which provides offenders with additional resources to reduce crime, and; 2) the Assessment and Referral Court List which is a specialist list of services designed to meet the needs of offenders who suffer from mental health issues or cognitive impairments. It should be noted that the commission of violent crimes as an index offence often render an offender ineligible to partake in drug diversion programs. Participants could also self-refer to the study.

Inclusion Criteria. Participants were required to be at least 18 years of age, have committed a crime within six months prior to the interview and used benzodiazepines at least once per month in the six months prior to the interview to partake in the study.

The present study utilised an archival dataset of 82 offenders aged between 21–56 years (M_{age} = 34.7, SD_{age} = 6.96). Of the sample, the majority were male (79.3%), with 12.2% identifying as Aboriginal and 2.4% identifying as Torres Strait Islander. The majority of participants completed grades 7–9 (37.8%) and 10–11 (39.0%) of Highschool. Of the sample,

18.3% were homeless, 87.8% were unemployed and 11.0% engaged in criminal activity as a source of income. The majority of the recruited sample self-reported mental health concerns in the month prior to the crime event, with 82.9% of participants being diagnosed with a mental health condition. Depression (62.2%) and anxiety (43.9%) were among the most common mental health diagnoses experienced by participants. Bipolar (24.4%), panic disorder (20.7%), and short-term drug induced psychosis (22.0%) were also common among participants. Figure 1 displays the mental health profile of the recruited sample.

The majority of the sample (96.3%) had been engaged in Alcohol and Other Drug treatment programs in the past and 85.4% were engaged in drug treatment at the time of interview. Of those engaged in treatment, the majority were being treated for heroin use (62.2%), and only 2.4% were being treated for alprazolam use. Of those prescribed benzodiazepines, the majority used diazepam (78.0%) and temazepam (63.4%) correctly; whereas, alprazolam was used incorrectly by 58.5% of the sample.

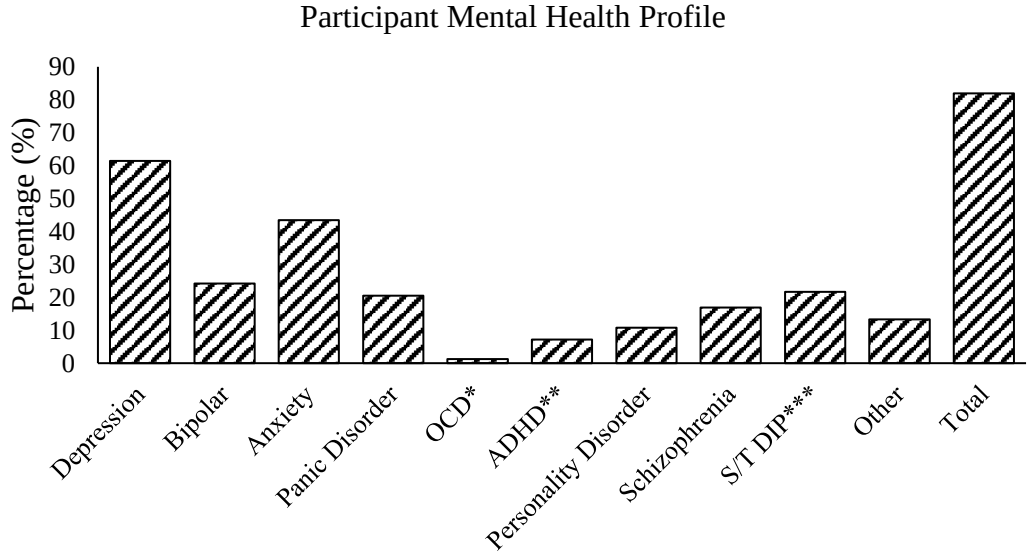

Figure 1. Mental Health Profile of the Recruited Sample. *Note:* *Obsessive Compulsive Disorder; **Attention Deficit Hyperactivity Disorder, ***Short Term Drug Induced Psychosis

Approximately 63.4% of participants were diagnosed with two or more co-occurring mental health conditions. Figure 2 displays the number of mental health diagnoses experienced by participants.

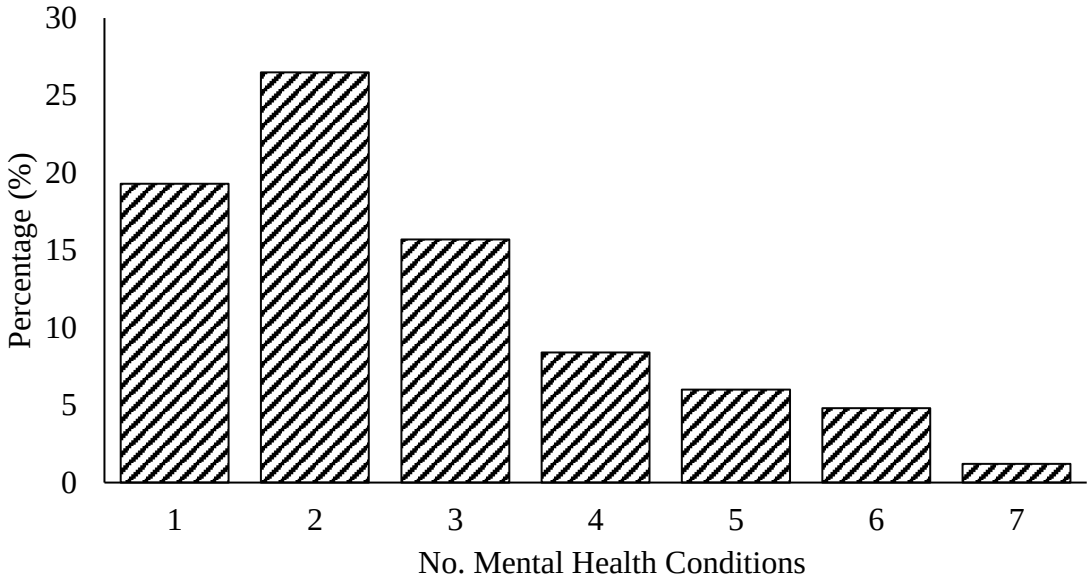

Figure 2. Number of Mental Health Diagnoses Experienced by Participants.

Measures

Criminality Scale of the Opiate Treatment Index (OTI; Darke, Ward, Hall, Heather, & Wodak, 1991). The criminality scale of the OTI assesses involvement in recent criminal activity across four crime areas: property crime, dealing, fraud, and violent crime (Darke et al., 1991). Respondents indicate on a 5-point Likert scale (ranging from 0 = *No Crime* to 4 = *Daily*), the frequency of engagement in each type of crime in the previous four weeks. Questions include 'How often, on average, during the last month have you committed a property crime?' (e.g., property crime) and 'How often, on average, during the last month have you committed a crime involving violence?' (e.g., violent crime). A total score is determined by summating all item responses from each of the four crime domains, whereby higher scores are reflective of more frequent crime engagement.

The measure demonstrates adequate psychometric properties. In terms of reliability, the criminality scale of the OTI demonstrates strong test-retest reliability, $r = 0.96$ (Darke et

al., 1991), internal consistency (Cronbach's α = 0.86; Adelekan et al., 1996), and inter-rater reliability, *ICC* = 0.69, 95% CI [0.55-0.83] (González-Saiz & García-Valderrama, 2012). In terms of validity, the scale demonstrates adequate collateral validation with 76% agreement between partners on the property crime domain, 94% agreement between partners on the violent crime domain, 84% agreement between partners on the dealing domain, and 90% agreement between partners on the fraud domain (Darke et al., 1991). The measure also has adequate discriminant validity as evidenced by significant negative correlations (*r* = -0.45) with the Global Assessment of Functioning Scale (González-Saiz & García-Valderrama, 2012).

Severity of Dependence Scale (SDS; Gossop et al., 1995). The SDS is a five item self-report measure designed to assess the degree of dependence experienced by users of different types of drugs. Items are scored on a 4-point Likert scale (ranging from 0 = *Never/Almost Never/Not Difficult* to 3 = *Always/Nearly Always/Impossible*). Questions include 'Did the prospect of missing a shot/snort make you very anxious or worried?' and 'Did you ever think your use of (drug of choice) was out of control?'. The item content of the SDS reflects the psychological components of dependence (e.g., an individual's lack of control over drug taking or preoccupations and anxieties about drug use). A total score is obtained by summating all item responses, whereby higher scores are reflective of a higher level of drug dependence (Gossop et al., 1995). In this study, the SDS was utilised to measure dependence to benzodiazepines, opioids, alcohol, and amphetamines in the four weeks prior to the crime event.

The measure demonstrates adequate psychometric properties. In terms of reliability, the SDS has strong test-retest reliability, *r* = 0.88, and internal consistency (Cronbach's α = 0.83; Martin, Copeland, Gates, & Gilmour, 2006). The SDS also has excellent inter-rater reliability (*ICC* < 0.75) across all total scores for alcohol, cannabis, crack cocaine, and

powder cocaine (Ferri et al., 2000). The construct validity of the SDS was also deemed as adequate using principal components analysis (PCA). A single factor structure was revealed for alcohol and cannabis, accounting for between 54.8% and 70% of the variance in the model (Ferri et al., 2000). The SDS also has strong concurrent validity, $r = 0.80$ when correlated with DSM-IV criteria (Martin et al., 2006).

Timeline Follow Back (TLFB; Sobell & Sobell, 1992; Sobell, Brown, Leo, & Sobell, 1996). A 28-day TFLB method was utilised to measure engagement in substance using behaviours, criminal activity, and levels of psychological distress in the month prior to the index crime. A TLFB for the 24 hours prior to the index crime was also used to assess substance intoxication, substance withdrawal, and psychological distress in the hazard period. Two TLFB's were collected to determine any significant differences between the hazard period and control period. This method allows for an interviewer to ask the participant to retrospectively estimate their drug use in the four weeks prior to the crime event. The tool is effective in obtaining a variety of qualitative estimates of drug use (Sobell et al., 1996). A sample question includes 'What drugs were you regularly using in the month prior to the crime taking place?'.

Despite some concerns regarding the reliability of the TLFB method due to participants retrospective accounts of drug use and other behaviours, the tool has been widely validated across multiple settings. The measure has been sensitive to detecting changes in cannabis use and other drug use over time (Sobell et al, 1996). Among a sample of drug users, the measure demonstrated excellent test-retest reliability across three-time intervals (i.e., 30, 90, and 360 days prior to the time one interview), as evidenced by strong positive correlations, $r = 0.75$ to $r = 0.96$ (Robinson, Sobell, Sobell, & Leo, 2014). Among cannabis users, the tool demonstrated strong temporal stability when measuring the quantity of daily drug use, $ICC = 0.83$, and the frequency of drug use, $ICC = 0.93$ for the same 90-day period

between time one and time two (Norberg, Mackenzie, & Copeland, 2011). The tool also has excellent inter-rater reliability, *ICC* = 0.99 (Norberg et al., 2011). In terms of validity, the measure has adequate collateral validation, *ICC* = 0.92, 95% CI [0.88, 0.94] and convergent validity, *r* = 0.73. To measure divergent validity, the tool was correlated with scores on the Marlowe-Crowne Social Desirability Scale (MCSDS; Strahan & Gerbaski, 1972), and drug use was found to be non-significantly correlated, $p < 0.66$, with items relating to positive impression management (Norberg et al., 2011).

Kessler (K-10) Psychological Distress Scale (Kessler et al., 2003). The K-10 is a 10-item self-report measure designed to assess psychological distress in the previous four weeks. Items are scored on a 5-point Likert scale (ranging from 1 = *None of the time* to 5 = *All of the time*). Questions include 'During the last 30 days, about how often did you feel nervous?' and 'During the last 30 days, about how often did you feel tired out of no good reason?'. A total score is obtained by summating all item responses, whereby higher scores are reflective of more severe psychological distress. Respondents are then categorised into one of three risk ranges depending on the severity of their anxious or depressive presentation: 10 to 15 = *low or no risk,* 16 to 29 = *medium risk,* and 30 to 50 = *high risk.* For the current study, the K-10 was modified to measure psychological distress in the month following the crime event and improvement/deterioration in functioning during the hazard period (12-24 hours prior to crime event) to identify psychological triggers for offending.

The K-10 has adequate psychometric properties. In terms of reliability, the measure has strong internal consistency (Cronbach's $\alpha = 0.88$; Ordinal $\alpha = 0.92$; Sampasa-Kanyinga, Zamorski, & Colman, 2018), and test-retest reliability, *ICC* = 0.77, 95% CI [0.62, 0.86] (Ataei, Malek, & Shamshirgaran, 2015). In terms of validity, the K-10 has adequate convergent validity, *r* =0.63, 95% CI [0.62, 0.65], being significantly and positively correlated with both negative outcomes of distress and symptoms of DSM-IV mental

disorders. The measure also has adequate divergent validity, r = -0.60, 95% CI [-.062, -0.58], being significantly and negatively correlated with positive mental health symptoms (Sampasa-Kanyinga et al., 2018). The K-10 is effective in detecting psychological distress among distressed individuals (sensitivity = 86%; specificity = 83%; Sampasa-Kanyinga et al., 2018). Interviewers also rated their confidence in the reliability of information being provided by participants as an additional measure of validity.

Urgency, Premeditation, Perseverance and Sensation Seeking Scale (UPPS; Whiteside & Lynam, 2001). The UPPS is a 46 item self-report measure designed to assess impulsivity across four main dimensions: lack of premeditation, urgency, sensation seeking, and lack of perseverance (Whiteside & Lynam, 2001). Items are scored on a 4-point Likert scale (ranging from 1 = *agree strongly* to 4 = *disagree strongly*). Some items require reverse scoring. The mean of subscale scores is obtained and converted into a percentile rank whereby a higher percentile is indicative of greater impulsivity. Questions include 'When I feel rejected, I will often say things that I later regret' (e.g., urgency) and 'I would enjoy water skiing' (e.g., sensation seeking).

The UPPS has adequate psychometric properties. In terms of reliability, the measure has strong internal consistency (Cronbach's α = 0.88; Cyders, Littlefield, Coffey, & Karyadi, 2014), and strong test-retest reliability across domains: lack of premeditation (r = 0.85), urgency (r = 0.87), sensation seeking (r = 0.92), and lack of perseverance (r = 0.85; Billieux et al., 2012). In terms of validity, the UPPS has strong divergent validity (r = 0.67) and convergent validity (r = 0.84; Whiteside, Lynam, Miller, & Reynolds, 2005). The UPPS also predicts impulsive externalising behaviours (e.g., substance use and antisocial behaviours), indicating the measure has adequate predictive validity. Confirmatory factor analysis has also confirmed a four-factor model of impulsivity, supporting the construct validity of the UPPS (Whiteside et al., 2005).

Procedure

The current study was promoted to Drug Diversion Services at the courts by using pamphlets and flyers. These were provided to services interested in partaking to gauge interest for study participants. Liaison with managers from these services allowed for efficient recruitment and on-site interviewing at courts administering drug treatment orders. Participants referred to the study (e.g., self-referral or service-referral) were screened for eligibility according to the inclusion criteria. Eligible participants engaged in structured open-ended qualitative interviews by trained interviewers. Face-to-face and telephone interviews were conducted and lasted approximately 45-60 minutes. The index crimes were focussed on within participant interviews. All interviews were audio-recorded and transcribed verbatim.

Design

The study utilised a case-crossover design. This design reduced the potential biases associated with recruiting different cases and controls as seen in conventional case-control studies (Wu & Anthony, 2000). An event-based approach was utilised in which participants substance use in the hazard and control period was compared. The hazard period refers to the 12-24 hours prior to a crime event. This timeframe was selected, as the biological effects of most substances will occur within this period. The control period refers to the 28 days prior to the crime event. The crime event refers to the participants' most recent conviction (index crime; refer to Figure 3 for a breakdown of the participant crime profile). The predictor variables were the type of drug consumed in the hazard and control period, and the outcome variable was engagement in a crime. Please refer to Table 1 for a breakdown of covariates, predictor, and outcome variables.

Statistical Analyses. All analyses were planned a priori. Descriptive statistics were analysed using the IBM Statistical Package for the Social Sciences (SPSS) version 24.0. Incidence Rate Ratios were calculated using multilevel mixed-effects negative binomial

regression models using count data in STATA (the menbreg command in v15). These models included an assessment of length of exposure in order to recalibrate models to incorporate the difference in duration of hazard and control periods. Prior to analysis, one participant was removed from the dataset due to missing responses. A significance cut off of $p < .05$ was used in all analyses.

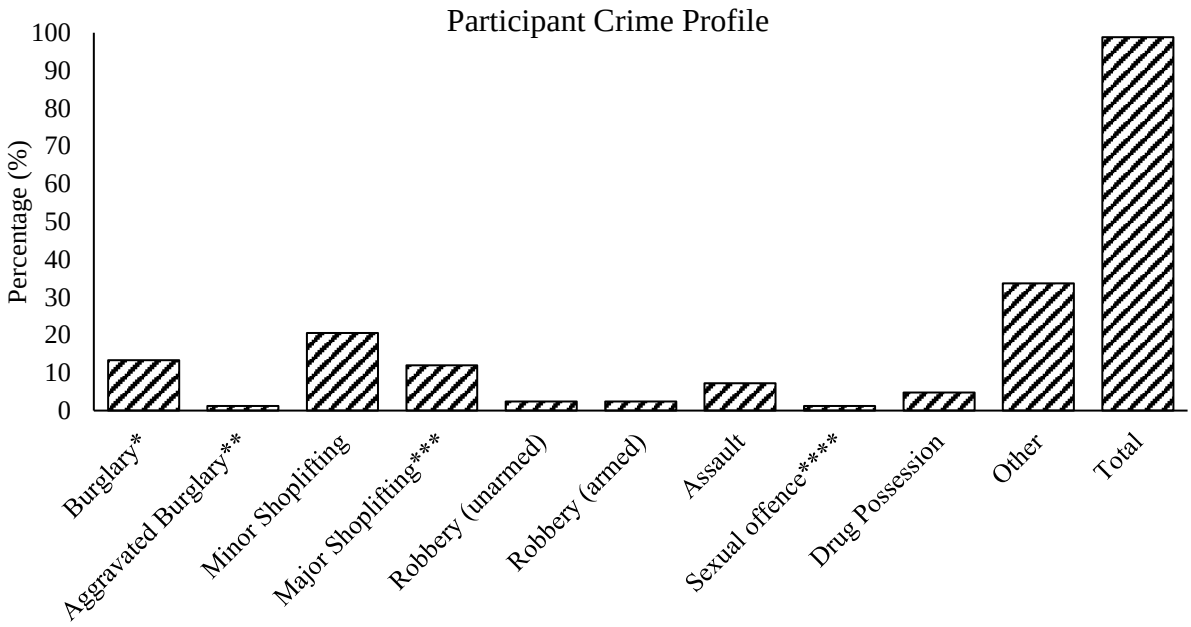

Figure 3. Crime Profile of the Recruited Sample. *Note:* *person not present, **person present, ***above $600, ****including rape

Table 1

Predictor, Outcome, and Covariates for Analysis

Predictor Variables	Outcome Variable	Covariates
Alprazolam use	Criminal Activity	Age
Temazepam use	(index crime)	Gender
Diazepam use		Psychological Distress
Methadone use		Impulsivity
Heroin use		Intoxication
Amphetamine use		Withdrawal
Alcohol use		General Crime Engagement
Cannabis use		

Results

Descriptive Statistics

Frequency Analysis. The percentage of use for all drug variables in the hazard and control periods were examined via frequency analyses. As indicated in Table 2, 42.9% of participants endorsed using alprazolam in the hazard period and 57.1% of participants endorsed using alprazolam in the control period. Among those reporting alprazolam use, the drug was used on a median of 13 of the previous 28 days. The interquartile ranges among those who used drugs are also presented.

Table 2.

Frequency percentages, Median, and Interquartile Ranges for each Drug Variable

Drug Type	Hazard (%)	Control (%)	Days used in past month (among those that used)	Interquartile Range (IQR)
Alprazolam	42.9	57.1	13	24
Diazepam	42.0	58.0	28	20
Temazepam	18.2	81.8	4	24
Amphetamines	20.5	79.5	4	6.5
Heroin	42.1	57.9	28	20
Methadone	45.3	54.7	28	0
Cannabis	44.2	55.8	28	12
Alcohol	40.2	59.8	14	20

Note: (N = 82)

Modelling associations between acute substance use and crime: Benzodiazepines

The current study estimated the incidence rate ratio (IRR) for alprazolam, diazepam, and temazepam associated with the commission of a crime in the hazard period using crude and multivariate models. The multivariate analyses comprised of models with an increasing number of covariates (Table 3). The following covariates were included: model 1: demographic factors (age, gender); model 2: demographic factors, psychological distress, and impulsivity; model 3: demographic factors, psychological distress, impulsivity, intoxication, and withdrawal; and model 4: demographic factors, psychological distress, impulsivity, intoxication, withdrawal, and general crime engagement.

Alprazolam. The unadjusted (crude) *IRR* indicates that participants were 42% more likely to commit a crime if they had used alprazolam in the hazard period, although this result was not statistically significant, $p = 0.120$. The fully adjusted *IRR* was 1.62, 95% CI [1.17-

2.24], $p = 0.003$, indicating that when controlling for demographics, psychosocial factors, and general crime engagement, participants were significantly more likely (62%) to commit a crime if they had used alprazolam in the hazard period.

Diazepam. The unadjusted (crude) *IRR* indicates that participants were 4% more likely to commit a crime if they had used diazepam in the hazard period, although this result was non-significant, $p = 0.848$. After controlling for all covariates, the *IRR* only slightly increased and remained non-significant, $p = 0.606$. This indicates that there is not a strong association between diazepam use and the commission of criminal activity in the current sample.

Temazepam. The unadjusted (crude) *IRR* indicates that participants were 4% more likely to commit a crime if they had used temazepam in the hazard period, although this result was non-significant, $p = 0.971$. After controlling for all covariates, the *IRR* decreased by approximately 40% and remained non-significant, $p = 0.738$. This indicates that in the current sample, temazepam use was not significantly associated with criminal activity in the hazard period.

Table 3.

Crude and Multivariate Incidence Rate Ratios for Alprazolam, Diazepam, and Temazepam (N = 82).

	Alprazolam			Diazepam			Temazepam		
	IRR	95% CI	*p*	*IRR*	95% CI	*p*	*IRR*	95% CI	*p*
Crude	1.42	0.91-2.21	0.120	1.04	0.70-1.56	0.848	1.04	0.13-8.27	0.971
Model 1	1.41	0.91-1.21	0.127	1.05	0.70-1.58	0.807	0.79	0.07-8.67	0.844
Model 2	1.54	0.96-2.46	0.074	1.10	0.72-1.69	0.649	0.59	0.04-8.35	0.697
Model 3	1.56	0.97-2.49	0.065	1.07	0.70-1.66	0.730	0.64	0.05-8.71	0.736
Model 4	1.62	1.17-2.24	0.003**	1.12	0.73-1.72	0.606	0.64	0.05-8.97	0.738

Note: Model 1: demographic factors (age, gender); Model 2: demographic factors, psychological distress, impulsivity; Model 3: demographic factors, psychological distress, impulsivity, intoxication, withdrawal; Model 4: demographic factors, general crime engagement, psychological distress, impulsivity, intoxication, withdrawal.

Modelling associations between acute substance use and crime: Other drug types

Findings from the models run for amphetamines, heroin, methadone, cannabis, and alcohol indicated that both the unadjusted and adjusted *IRR*'s were non-significant in all instances. The majority of these models indicated that drug use was associated with non-significant increases in the likelihood crimes would be committed in the hazard period. Conversely, results demonstrated that methadone was uniquely associated with a decreased likelihood of criminal activity in the hazard period, although at non-significant levels. When controlling for basic demographic factors, cannabis was also associated with non-significant decreases in the likelihood of crime commission in the hazard period.

When controlling for demographic factors, psychological distress, and impulsivity in the amphetamine drug group, the multivariate models would not converge. The same was seen in the unadjusted model for cannabis. This may indicate that across these drug variables, there was not enough variation between the two time periods (e.g., hazard and control) for there to be a difference in results.

Chi Square Analysis

There was insufficient power to analyse associations between substance use and crime separately for each crime type. A chi square test was conducted to assess whether alprazolam use was more highly associated with the commission of acquisitive or violent crimes. Alprazolam was used by 7 of the 11 people who engaged in violent crimes (i.e., 63%) and by 28 of the 48 people who engaged in acquisitive crimes (i.e., 58%). As such, the results indicated that there was no significant difference between the two groups, χ^2 (3, 59) = 0.10, p = .747. This indicates that alprazolam use was not significantly associated with one crime type over another. However, this may be attributed to the limited power of the analysis given the small sample size (n = 59), rather than a null association.

Table 4.

Crude and Multivariate Incidence Rate Ratios for Amphetamines, Heroin, Methadone, Cannabis, and Alcohol (N = 82)

	Amphetamines			Heroin			Methadone			Cannabis			Alcohol		
	IRR	95% CI	*p*	*IRR*	95% CI	*p*	*IRR*	95% CI	*p*	*IRR*	95% CI	*p*	*IRR*	95% CI	*p*
Unadjusted	1.13	0.58-2.22	0.717	1.01	0.65-1.59	0.953	0.75	0.38-1.49	0.417	-	-	-	1.17	0.67-2.06	0.579
Model 1	1.07	0.54-2.15	0.840	1.02	0.65-1.61	0.923	0.75	0.38-1.50	0.423	0.99	0.64-1.54	0.989	1.17	0.66-2.06	0.598
Model 2	-	-	-	1.04	0.63-1.73	0.880	0.73	0.35-1.52	0.396	1.05	0.65-1.72	0.837	1.13	0.59-2.19	0.699
Model 3	1.35	0.50-3.64	0.546	1.08	0.65-1.80	0.763	0.73	0.35-1.51	0.393	1.06	0.64-1.73	0.831	1.14	0.58-2.22	0.704
Model 4	1.27	0.62-2.61	0.517	1.09	0.66-1.80	0.746	0.73	0.34-1.54	0.408	1.07	0.64-1.75	0.818	1.18	0.60-2.32	0.628

Note: Model 1: demographic factors (age, gender); Model 2: demographic factors, psychological distress, impulsivity; Model 3: demographic factors, psychological distress, impulsivity, intoxication, withdrawal; Model 4: demographic factors, general crime engagement, psychological distress, impulsivity, intoxication, withdrawal.

Discussion

This study examined the relationship between substance use and criminal activity by way of case-crossover design among a sample of offenders. The role of benzodiazepine use, particularly alprazolam, in the relationship between drug use and crime was a key area of investigation.

Benzodiazepine Use and Criminal Activity

Diazepam and Temazepam. Contrary to predictions, diazepam and temazepam use was not associated with increased criminal activity. It was clear within the current sample that these benzodiazepines were associated with high levels of non-prescribed use; however, this was to a lesser degree than alprazolam. This may indicate that diazepam and temazepam have a lower abuse potential than other more potent benzodiazepines (e.g., alprazolam; Apelt et al., 1990). When using a drug as prescribed, individuals are less likely to experience addiction and dependence, which may place them at a reduced risk of engaging in criminal behaviours to fund further drug use. This finding may also support the notion that these benzodiazepines are not associated with the same paradoxical effects and disinhibition as seen in alprazolam use, which could further explain a null relationship with criminal activity. Based on the findings, this may support evidence suggesting diazepam and temazepam are a safer option for prescribing. Although, caution should be taken in prescribing to those with a substance use history, given they are still associated with misuse (Wain et al., 2007). Given the high levels of non-prescribed use in the current sample, future research could further investigate the relationship between varying doses of diazepam/temazepam and propensity to commit crimes. Specifically, if high doses (e.g., binging) or polysubstance use contribute to an increase in criminal activity.

Alprazolam. Alprazolam use was found to be uniquely associated with the commission of criminal activity in the current study. The highly addictive nature of

alprazolam use has been consistently demonstrated within the literature (e.g., Ait-Daoud et al., 2018; SAMHSA, 2013). This study provides further evidence for the dangers associated with alprazolam use among offenders, particularly those with drug use histories who are susceptible to drug addiction and dependence.

There are a number of possible explanations for this relationship in the context of the drug-crime nexus. For example, continued alprazolam use could lead to addiction/dependence, subsequently prompting engagement in criminal behaviours to fund further drug use. This may be evidenced by the high proportion of acquisitive offending in the current sample. Alternatively, this could be explained by the unique paradoxical effects associated with the use of alprazolam. For example, individuals may have been disinhibited with a reduced capacity for decision making and an increased sense of novelty seeking after using the drug (Lane et al., 2005). This may be supported by the large proportion of individuals who used alprazolam prior to engaging in property crimes (e.g., 58%). This is supported by qualitative data, '*One of the first times I took alprazolam I found myself with a bag full of shoplifting from a chemist which I couldn't recall'.* This could also be driven by drug-induced memory failure, given the impairing effects alprazolam use can have on metacognition. The study's findings may also support the anecdotal suggestions that alprazolam use is associated with increased aggression in humans given 63% of individuals who engaged in violent crimes had used alprazolam in the hazard period. Furthermore, given the high level of mental health conditions in the current study it is possible that psychological vulnerabilities (outside of psychological distress which was controlled for) played a role in making individuals more susceptible to engaging in criminal activity and using drugs. This may be particularly important if alprazolam was prescribed for a mental health condition. When considering these explanations, the current findings have important clinical implications for health practitioners continuing to prescribe alprazolam.

Given the current findings, adopting a universal precaution approach similar to that implemented for strong opioids (e.g., morphine; Monheit, 2010) is recommended, as alprazolam is also a schedule eight drug. This emphasises the importance of accurate assessment and diagnosis of substance use issues. In light of the current findings, universal precautions specific to alprazolam should also include a thorough assessment of the patient's forensic history.

The following recommendations are made for health practitioners to adequately assess for substance use issues. Included in this assessment should be a thorough investigation of the patients' prior pharmaceutical drug use and any associated drug use behaviours (e.g., binging). It is important for health practitioners to screen for a history of polysubstance use or engagement in current polysubstance use. Of major concern is the presence of alcohol or other depressant drug use. Not only is there an increased risk of lethal depressant drug use interactions, should alprazolam be consumed in conjunction with these substances, but the combination could increase the risk of disinhibition, aggression, and lead to a greater propensity to commit crimes (e.g., Bond & Silvieri, 1993). Long term substance use histories may have cognitive impacts as characterised by deficits in memory, decision-making, and impaired judgement. This could be further exacerbated if alprazolam is consumed, placing individuals at an increased risk for criminal involvement (Kurzthaler et al., 2005). This is supported by qualitative data , '*I can't even remember to tell you the truth; I woke up in the morning and found stupid things in my bag, like how can I put it, like things that wouldn't mean anything, like I woke up with like 100 cups or something, stupid stuff*'.

Of equal importance is ensuring the patients' forensic history is adequately explored. Given the current findings were limited to a sample of offenders, it is not clear if these results could be generalised to a clinical population. Thus, the positive relationship between alprazolam and criminal activity could be attributed to factors that are more prevalent in an

offending population. For example, there is an increased prevalence of substance use, addiction, and dependence in forensic settings. Therefore, offenders may be at a greater risk of engaging in non-prescribed use that could lead to addiction and subsequent acquisitive offending. This cycle may be more prevalent in forensic rather than clinical settings. Offenders may be more susceptible to engaging in violent behaviours if they already have underlying aggressive tendencies. There may also be a higher prevalence of impulsivity and risk seeking behaviour in forensic settings. This could be exacerbated under the influence of alprazolam if intoxication leads to impairments in consequential thinking and subsequent engagement in crime. Additionally, unless working directly in a forensic setting or treating court mandated individuals, it can be difficult to ascertain whether the client/patient has a forensic history. If considering prescribing alprazolam, it is important to explore criminal history, as the presence of prior engagement in crime may place them at a greater risk for criminal involvement.

The current recommendations also support existing guidelines for the prescribing of alprazolam given it can be associated with disinhibition. For example, the Royal Australian College of General Practitioners (RACGP) have recommended the drug should be prescribed in low dosages and for short time periods only (e.g., between two and four weeks, with approval required after four weeks; RACGP, 2015). The British Association for Psychopharmacology (BAP) has also suggested, alprazolam is not considered a first line treatment option for anxiety. Alprazolam should only be prescribed if other psychological (e.g., Cognitive Behavioural Therapy, CBT) or pharmacological interventions are not successful (e.g., Selective Serotonin Reuptake Inhibitors (SSRIs); Baldwin et al., 2014). Given the dangers associated with alprazolam and other drug use, should a patient require a medication with calming effects, Seroquel may be more appropriate. Seroquel is not

associated with the same negative interactions with other opioids and alcohol, or the cognitive impairing effects seen in long term benzodiazepine use (de Geus et al., 2007).

Other drug use and criminal activity

This study did not find any significant associations between other illicit drug and alcohol use and criminal activity even after controlling for covariates. These findings were surprising given extant literature demonstrating positive associations between drug use and criminal engagement (e.g., Comiskey et al., 2012; Goldsmid & Willis., 2016; Pierce et al., 2015; Sommers & Baskin., 2006). Interestingly, when examining the direction of the relationship between methadone use and crime, non-significant decreases were observed. Although non-significant, the decrease in crime is consistent with evidence in favour of methadone maintenance treatment programs (Fiellin et al., 2006). The benefits of methadone maintenance may also be supported by the non-significant increases in criminal activity following heroin use. Further examination of the relationship between opioid use, particularly methadone, and crime is warranted, especially if methadone treatment programs can help to reduce offending among opioid users.

No relationship between methamphetamine use, cannabis use, and crime was found in the current study. Although use was observed in the hazard period, the strength of the relationship was not enough to reach statistical significance. This contradicts the findings of Goldsmid and Willis (2016) who positively predicted engagement in acquisitive crime following methamphetamine or cannabis use; and Sommers and Baskin (2006) who found strong positive associations between intoxication and methamphetamine-related violence. The current findings support the notion that there is not a single pattern of abuse trajectory (Sommers & Baskin, 2006) and although theoretical models suggest drug use may place individuals at an increased risk for criminal involvement, this is not an inevitable outcome. This result could also be explained by the characteristics of the current sample, in that there

was a high proportion of substance use. There may be a higher likelihood of observing an association between drug use and crime or an increased frequency of crime in a general population of people or offenders.

When considering alcohol, previous research consistently indicates there is a positive association between consumption and criminal activity (Haggard-Grann et al., 2006; Kurzthaler et al., 2005; Weerts & Miczek, 1996). This is evident when consuming alcohol in combination with other substances, particularly benzodiazepines, due to the presence of depressant interactions. Current findings do not support this as no relationship was found between alcohol use and crime. Given previous studies have spoken to the dangers associated with combining alcohol and benzodiazepines (e.g., Weerts & Miczek, 1996) further examination of the interplay between alcohol, alprazolam use and crime is important.

Alprazolam Use: Violent and Acquisitive Offending

The current findings did not support predictions regarding alprazolam use being more highly associated with violent crime. The small body of research examining the relationship between alprazolam and criminal activity has found that those who experience the paradoxical effects of the drug are more likely to express aggression and violence. This could precipitate engagement in violent offences (Albrecht et al., 2016). This is supported by qualitative data, '*I've never really been too violent but at a time when I took Rivotril and Alprazolam together the next day I know my girlfriend at the time, I think she threw away my, the other Rivotril I had left over for the next day and that made me so angry that I trashed my own apartment… the police were called and I was acting really irrationally and I ended up getting capsicum sprayed and arrested for the night'.* Therefore, it is surprising that although alprazolam use in the current sample was significantly associated with increased likelihood of criminal engagement, it was not more highly associated with violent crimes over other types of acquisitive offences. It is thought this finding could be attributed to methodological

weaknesses rather than a true null result. For example, as participants were recruited from Drug Diversion Services that prohibited violent offenders from engaging in treatment, there was a large disproportion between the quantity of violent and acquisitive offences in the sample. Thus, there was not enough power in the sample to investigate the relationship between alprazolam the two types of crime (i.e., violent and acquisitive) separately. If violent offenders were more represented in the sample, and there was greater power to investigate the relationship between alprazolam use and violent crime, the results may have been consistent with the findings of Albrecht and colleagues (2016).

Clinical Relevance

The current study has important clinical implications for offenders who use alprazolam and for clinicians and health professionals who prescribe the drug in those with substance use and forensic histories. Although there is evidence in the literature that suggests alprazolam is effective in treating anxiety and related conditions (Verster & Volkerts, 2004), there is also significant evidence suggesting alprazolam use can be associated with rebound anxiety following discontinuation of use. Alprazolam use is associated with withdrawal syndrome more severe than other benzodiazepines, even after following guidelines to taper doses (Ait-Daoud et al., 2018). When considering this, in combination with the findings of the current research which provide strong evidence for alprazolam's association with engagement in crime, other treatment options should be considered for anxiety disorders.

Psychological interventions such as CBT have been consistently found to be associated with long-term reductions in anxiety. Comparatively, CBT is associated with smaller rates of relapse than benzodiazepines when used to treat anxiety and insomnia (Morin et al., 2005; Noyes et al., 1991). Other psychological interventions such as mindfulness and behavioural approaches (e.g., exposure therapy) are associated with positive treatment outcomes for anxiety (Yoon et al., 2017). The absence of physical side effects and

withdrawal symptoms also support the benefits of psychological interventions for anxiety. Health care providers should consider referring patients to seek psychological support for anxiety as an alternative to benzodiazepine treatment. This is important if the individual has a substance use or forensic history. Combining psychological interventions and alprazolam has been efficacious in treating anxiety and panic disorder (e.g., Hegel et al., 1994). Despite this, in light of the current findings, and addictive nature of alprazolam, caution should be used prior to prescribing the drug as it could lead to increased engagement in crime. Should a combined psychological and pharmacological approach be preferred, consideration should be given to other less potent benzodiazepines (e.g., diazepam) or other medical options (e.g., SSRI's) that are less associated with criminal behaviour (Balwin et al., 2014).

The current findings shed light on the unique risks associated with alprazolam use. It is important not only to consider restricting access to the drug by way of prescription, but also for the development of alprazolam specific treatment programs. This could entail aiding individuals in safely detoxing, managing rebound anxiety/panic through the use of relaxation or other cognitive behavioural approaches (e.g., thought challenging, interoceptive exposure), developing strategies to manage cravings associated with addiction or dependence, and monitoring safe alprazolam use. Embedded within such a program is the importance of psychoeducational components about the abuse and criminal engagement risks associated with the use of alprazolam. Further research into the development of such a program is warranted, given the high rates of continued alprazolam misuse.

Limitations and Future Direction

There are limitations in the current research that need to be considered when interpreting the results. The small sample size and limited power of the study yielded several disadvantages in terms of the types of analyses that could be conducted. Firstly, only single drug types could be examined in the binomial regression models, as there was not enough

power in the sample to examine interactions between drug types. This was a noteworthy limitation as there are clear links in the literature between the use of alprazolam in conjunction with other drugs (e.g., alcohol) and engagement in criminal activity (e.g., Haggard-Grann et al., 2006). There was strong evidence of polydrug use in the current sample. The role of polydrug use in the relationship between alprazolam and crime could not be further investigated. Despite this, the current findings strongly support the unique positive relationship between alprazolam misuse and criminal engagement.

Secondly, significantly more participants committed acquisitive crimes in the current sample than violent crimes, 58.5% versus 13.4% respectively (i.e., note the proportion of the sample involved in other types of crime, for example failing to appear in court). This is likely because a primary recruitment source was through drug diversion programs, whereby violent crimes render the offender ineligible to participate. Additionally, due to the limited power of the sample, it was difficult to differentiate whether alprazolam or other drug use was more strongly associated with acquisitive or violent offending using binomial regression models. Further studies should endeavour to recruit a larger sample with a more balanced spread of crime types to overcome this limitation.

Thirdly, some drugs showed little variation in the models across the two time periods (e.g., cannabis). This is likely the result of the recruited sample being a heavy drug using population, whereby drug use behaviours are generally consistent. Thus, there may have been some difficulty in distinguishing the hazard period from the control period (e.g., general drug use) for drugs like cannabis, when participants were using every day. The current study could have benefited from recruiting participants from a more general crime population rather than predominantly through drug diversion programs.

Fourthly, the findings of the current study are limited to only those in an offending population. The results cannot be generalised to individuals who use alprazolam in non-crime

populations as the recruited sample consisted only of those individuals who had committed an offence. Further research should endeavour to investigate the relationship between alprazolam use and propensity to commit crimes among individuals prescribed or using alprazolam in the general population. Despite this, the current study has demonstrated strong findings among a crime population. Although, further research is warranted, the results provide continued support for the literature advising against the prescribing of alprazolam, particularly among those with substance use histories.

Finally, there are some limitations associated with the use of a TLFB method among substance using populations. The efficacy of this method has been demonstrated in cannabis users (Sobell et al, 1996). However, there are some concerns regarding retrospective accounts of substance use behaviours for drugs like benzodiazepines and alcohol when there is a delay between the incident and the time of interview. This may be attributed to the cognitive impacts that repeated use of drugs has on cognitive functioning, attention, and memory (Kurzthaler et al., 2005). When considering a common side effect of alprazolam use is disinhibition, it is likely that possible memory impairment is associated with this. To account for this, the current study utilised an inbuilt validity measure, whereby interviewers rated participants quality of recall on a Likert type scale from zero to ten. This data was only gathered for 19.5% of the participants interviewed. Of the quality of recall data that was collected, 87.7% of participants were rated as having a quality of recall above six. Due to the small percentage of participants who were rated on recall ability, it cannot be concluded that participant recall was accurate and did not methodologically impair the study results. Therefore, the results should be interpreted with caution.

Despite these caveats, the current study was effectively able to establish strong links between the misuse of alprazolam and criminal involvement and has a number of noteworthy strengths. For example, multiple benzodiazepines, pharmaceutical opioids, and illicit drugs

were explored, allowing for a broader investigation of the drug-crime link. The study design allowed for the unique observation of the relationship between drug use and crime while controlling for the influence of extraneous factors. Finally, this is the first study to our knowledge specifically examining the link between alprazolam use and criminal activity using a case-crossover design.

Conclusion

The current study builds on the small body of literature indicating that the possible acute paradoxical effects or disinhibition associated with alprazolam use is linked with an increased likelihood for criminal involvement. The high potential for alprazolam abuse and unique association with criminal activity has important implications for health care providers prescribing alprazolam for anxiety or related conditions. This study highlights the importance of the short term prescribing of the drug, particularly if addiction, abuse, or disinhibition lead to engagement in criminal activity after use. The importance of a thorough assessment of the patients' substance use and forensic history, in light of the current findings is paramount. This study provides further encouragement for the use of psychological interventions such as CBT in the treatment of anxiety, particularly as a safe alternative to those who may present within a forensic setting or have difficulties with substance use. Further investigation into the development of an alprazolam specific treatment program to aid individuals in safely managing cravings, detoxing, and monitoring alprazolam use is recommended. The anti-anxiety properties of alprazolam are outweighed by the high likelihood of abuse, increased potential for criminal engagement, and possible risks posed to community safety in those who are committing alprazolam related crimes when there are other treatment options available.

References

Adelekan, M., Green, S., Dasgupta, N., Tallack, F., Stimson, G. V., & Wells, B. (1996). Reliability and validity of the opiate treatment index among a sample of opioid users in the United Kingdom. *Drug and Alcohol Review, 15,* 261-270. doi: 10.1080/09595239600186001

Ait-Daoud, N., Hamby, A. S., Sharma, S., & Blevins, D. (2018). A review of alprazolam use, misuse, and withdrawal. *Journal of Aaddiction Medicine, 12,* 4-10. doi: 10.1097/ADM.0000000000000350

Albrecht, B., Staiger, P. K., Hall, K., Kambouropoulos, N., & Best, D. (2016). Motivational drive and alprazolam misuse: A recipe for aggression? *Psychiatry Research, 240,* 381-389. doi: 10.1016/j.psychres.2016.04.040

Apelt, S., Schmauss, C., & Emrich, H. M. (1990). Preference for alprazolam as opposed to diazepam in benzodiazepine-dependent psychiatric inpatients. *Pharmacopsychiatry, 23,* 70-75.doi: 10.1055/s-2007-1014486

Ataei, J., Malek, A., & Shamshirgaran, S. M. (2015). Reliability and validity of the Persian version of the Kessler psychological distress scale among patient with type 2 diabetes. *Journal of Analytical Research in Clinical Medicine, 3,* 99-106. doi: 10.15171/jarcm.2015.015

Baldwin, D. S., Anderson, I. M., Nutt, D. J., Allgulander, C., Bandelow, B., den Boer, J. A., ... & Malizia, A. (2014). Evidence-based pharmacological treatment of anxiety disorders, post-traumatic stress disorder and obsessive-compulsive disorder: a revision of the 2005 guidelines from the British Association for Psychopharmacology. *Journal of Psychopharmacology, 28,* 403-439. doi: 10.1177/0269881114525674

Ball, J. C., Shaffer, J. W., & Nurco, D. N. (1983). The day to-day criminality of heroin addicts in Baltimore—A study in the continuity of offence rates. *Drug and Alcohol Dependence, 12,* 119-142. doi: 10.1016/0376-8716(83)90037-6

Bennett, T., Holloway, K., & Farrington, D. (2008). The statistical association between drug misuse and crime: A meta-analysis. *Aggression and Violent Behaviour, 13,* 107-118. doi:10.1016/j.avb.2008.02.001

Bentue-Ferrer, D., Reymann, J. M., Tribut, O., Allain, H., Vasar, E., & Bourin, M. (2001). Role of dopaminergic and serotonergic systems on behavioral stimulatory effects of low-dose alprazolam and lorazepam. *European Neuropsychopharmacology, 11,* 41-50. doi: 10.1016/S0924-977X(00)00137-1

Billieux, J., Rochat, L., Ceschi, G., Carre, A., Offerlin-Meyer, I., Defeldre, A., Khazal., Y… Van der Linden, M. (2012). Validation of a short French version of the upps-p impulsive behaviour scale. *Comprehensive Psychiatry, 53,* 609-615. doi: 10.1016/j.comppsych.2011.09.001

Bond, A. J., Curran, H. V., Bruce, M. S., O'Sullivan, G., & Shine, P. (1995). Behavioural aggression in panic disorder after 8 weeks' treatment with alprazolam. *Journal of Affective Disorders, 35*(3), 117-123.doi: 10.1016/0165-0327(95)00053-4

Bond, A. J., & Silveira, J. C. (1993). The combination of alprazolam and alcohol on behavioural aggression. *Journal of Studies on Alcohol, Suppl 11,* 30-39. doi: 10.15288/jsas.1993.s11.30

Butler, T., Andrews, G., Allnutt, S., Sakashita, C., Smith, N. E., & Basson, J. (2006). Mental disorders in Australian prisoners: a comparison with a community sample. *Australian & New Zealand Journal of Psychiatry, 40*, 272-276. doi: 10.1080/j.1440-1614.2006.01785.x

Ciraulo, D. A., Barnhill, J. G., Ciraulo, A. M., Sarid-Segal, O., Knapp, C., Greenblatt, D. J., & Shader, R. I. (1997). Alterations in pharmacodynamics of anxiolytics in abstinent alcoholic men: subjective responses, abuse liability, and electroencephalographic effects of alprazolam, diazepam, and buspirone. *The Journal of Clinical Pharmacology, 37,* 64-73. doi: 10.1177/009127009703700111

Collins, D., & Lapsley, H. M. (2008). *The costs of tobacco, alcohol and illicit drug abuse to Australian society in 2004/05* (pp. 41-47). Canberra: Department of Health and Ageing

Curtis, R., & Wendel, T. (2007). "You're Always Training the Dog": Strategic Interventions to Reconfigure Drug Markets. *Journal of Drug Issues, 37,* 867-891. doi: 10.1177/002204260703700407

Comiskey, C. M., Stapleton, R., & Kelly, P. A. (2012). Ongoing cocaine and benzodiazepine use: Effects on acquisitive crime committal rates amongst opiate users in treatment. *Drugs: Education, Prevention and Policy, 19,* 406-414. doi: 10.3109/09687637.2012.668977

Cyders, M. A., Littlefield, A. K., Coffey, S., & Karyadi, K. A. (2014). Examination of a short English version of the UPPS-P Impulsive Behavior Scale. *Addictive Behaviors, 39,* 1372-1376. doi: 10.1016/j.addbeh.2014.02.013

Dåderman, A. M., & Lidberg, L. (1999). Flunitrazepam (Rohypnol) abuse in combination with alcohol causes premeditated, grievous violence in male juvenile offenders. *The Journal of the American Academy of Psychiatry and the Law, 27,* 83-99. doi: 10.1016/j.pbb.2010.02.004

Darke, S., Ward, J., Hall, W., Heather, N. & Wodak, A. (1991). *The Opiate Treatment Index (OTI)Researcher's Manual.* National Drug and Alcohol Research Centre Technical Report Number 11. Sydney: National Drug and Alcohol Research Centre

DeLisi, M., & Piquero, A. R. (2011). New frontiers in criminal careers research, 2000–2011: A state-of-the-art review. *Journal of Criminal Justice, 39*, 289-301. doi: 10.1016/j.jcrimjus.2011.05.001

de Geus, F., Denys, D., & Westenberg, H. G. (2007). Effects of quetiapine on cognitive functioning in obsessive–compulsive disorder. *International Clinical Psychopharmacology*, *22*, 77-84. doi: 10.1097/YIC.0b013e32801182f7

Ericsson, E., Bradvik, L., & Hakansson, A. (2014). Mortality, causes of death and risk factors for death among primary amphetamine users in the Swedish criminal justice system. *Substance Use & Misuse, 49*, 262-269. doi: 10.3109/10826084.2013.825921

Falk, Ö., Wallinius, M., Lundström, S., Frisell, T., Anckarsäter, H., & Kerekes, N. (2014). The 1% of the population accountable for 63% of all violent crime convictions. *Social Psychiatry and Psychiatric Epidemiology*, *49*, 559-571. doi: 10.1007/s00127-013-0783-y.

Fazel, S., Bains, P., & Doll, H. (2006). Substance abuse and dependence in prisoners: A systematic review. *Addiction, 101*, 181-191. doi: 10.1111/j.1360-0443.2006.01316.x

Fazel, S., & Danesh, J. (2002). Serious mental disorder in 23 000 prisoners: A systematic review of 62 surveys. *The Lancet, 359*, 545-550. doi: 10.1016/S0140-6736(02)07740-1

Ferri, C. P., Marsden, J., de Araujo, M., Laranjeira, P. R., & Gossop, M. (2000). Validity and reliability of the Severity of Dependence Scale (SDS) in a Brazilian sample of drug users. *Drug and Alcohol Review, 19*, 451-455. doi: 10.1080/713659418

Fiellin, D. A., Friedland, G. H., & Gourevitch, M. N. (2006). Opioid dependence: rationale for and efficacy of existing and new treatments. *Clinical Infectious Diseases, 43*(Supplement_4), S173-S177.

Forsythe, L., & Adams, K. (2009). Mental health, abuse, drug use and crime: Does gender matter? *Trends & Issues in Crime and Criminal Justice*, (384), 1

Fry, C., Smith, B., Bruno, R., O'Keefe, B., & Miller, P. (2007). Benzodiazepine and pharmaceutical opioid misuse and their relationship to crime. *Hobart: National Drug Law Enforcement Research Fund*.

Goldsmid, S., & Willis, M. (2016). Methamphetamine use and acquisitive crime: Evidence of a relationship. *Trends and Issues in Crime and Criminal Justice*, (516), 1.

Goldstein, P. J. (1985). The drugs/violence nexus: A tripartite conceptual framework. *Journal of drug issues, 15*, 493-506. doi: 10.1177/002204268501500406

Gonzalez-Saiz, F., & García-Valderrama, T. (2012). The opiate treatment index (OTI) clinical interview: new evidence of its reliability and validity. *Heroin Addiction and Related Clinical Problems, 14,* 19-34. doi: 10.1080/09595239600186001

Gossop, M., Darke, S., Griffiths, P., Hando, J., Powis, B., Hall, W… Strang, J. (1995). The severity of dependence scale (SDS): psychometric properties of the sds in English and Australian samples of heroin, cocaine and amphetamine users. *Addiction, 90,* 607-614. doi: 10.1046/j.1360-0443.19959056072x

Gossop, M., Marsden, J., Stewart, D., & Rolfe, A. (2000). Reductions in acquisitive crime and drug use after treatment of addiction problems: 1-year follow-up outcomes. *Drug and Alcohol Dependence, 58,* 165-172. doi: 10.1016/S0376-8716(99)00077-0

Gould, R. A., Ott, M. W., & Pollack, M. H. (1995). A meta-analysis of treatment outcome for panic disorder. *Clinical Psychology Review, 15,* 819-844. doi: 10.1016/0272-7358(95)00048-8

Haggård-Grann, U., Hallqvist, J., Långström, N., & Möller, J. (2006). The role of alcohol and drugs in triggering criminal violence: a case-crossover study. *Addiction, 101,* 100-108. doi: 10.1111/j.1360-0443.2005.01293.x

Hammersley, R., Forsyth, A., Morrison, V., & Davies, J. B. (1989). The relationship between crime and opioid use. *British Journal of Addiction, 84,* 1029-1043. doi: 10.1111/j.1360-0443.1989.tb00786.x

Hegel, M. T., Ravaris, C. L., & Ahles, T. A. (1994). Combined cognitive-behavioral and time-limited alprazolam treatment of panic disorder. *Behavior Therapy, 25,* 183-195. doi: 10.1016/S0005-7894(05)80282-5

Iguchi, M. Y., Griffiths, R. R., Bickel, W. K., Handelsman, L., Childress, A. R., & McLellan, A. T. (1989). Relative abuse liability of benzodiazepines in methadone-maintained populations in three cities. *NIDA Research Monograph, 95,* 364. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/2577040

Jarvis, G., & Parker, H. (1989). Young heroin users and crime: how do the 'new users' finance their habits? *The British Journal of Criminology, 29,* 175-185. doi: 10.1093/oxfordjournals.bjc.a047814

Jones, K. A., Nielsen, S., Bruno, R., Frei, M., & Lubman, D. I. (2011). Benzodiazepines: Their role in aggression and why GPs should prescribe with caution. *Australian Family Physician, 40,* 862.

Junginger, J., Claypoole, K., Laygo, R., & Crisanti, A. (2006). Effects of serious mental illness and substance abuse on criminal offenses. *Psychiatric Services, 57,* 879-882. doi: 10.1176/ps.2006.57.6.879

Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., & Hipripi, E. (2003). Screening for serious mental illness in the general population. *Archives of General Psychiatry, 60,* 184-189. doi: 10.1002/mpr.333.

Krug, E. G., Mercy, J. A., Dahlberg, L. L., & Zwi, A. B. (2002). The world report on violence and health. *The Lancet, 360*(9339), 1083-1088.

Kurzthaler, I., Wambacher, M., Golser, K., Sperner, G., Sperner-Unterweger, B., Haidekker, A., ... & Fleischhacker, W. W. (2005). Alcohol and/or benzodiazepine use: different accidents—different impacts? *Human Psychopharmacology: Clinical and Experimental*, *20*, 583-589.doi: 10.1002/hup.736

Lane, S. D., Tcheremissine, O. V., Lieving, L. M., Nouvion, S., & Cherek, D. R. (2005). Acute effects of alprazolam on risky decision making in humans. *Psychopharmacology*, *181*, 364-373. doi: 10.1007/s00213-005-2265-8

Martin, G., Copeland, J., Gates, P., & Gilmour, S. (2006). The severity of dependence scale (SDS) in an adolescent population of cannabis users: reliability, validity, and diagnostic cut-off. *Drug and Alcohol Dependence, 83,* 90-93. doi: 10.1016/j.drugalcdep.2005.10.014

Michel, L., & Lang, J. P. (2003). Benzodiazepines and forensic aspects. *L'Encephale, 29*, 479-485. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/15029082

Moberg, T., Stenbacka, M., Tengström, A., Jönsson, E. G., Nordström, P., & Jokinen, J. (2015). Psychiatric and neurological disorders in late adolescence and risk of convictions for violent crime in men. *BMC Psychiatry*, *15*, 299. doi: 10.1186/s12888-015-0683-7

Monheit, B. (2010). Prescription drug misuse. *Australian Family Physician, 39*, 540. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20877745

Morin, C. M., Bélanger, L., Bastien, C., & Vallières, A. (2005). Long-term outcome after discontinuation of benzodiazepines for insomnia: a survival analysis of relapse. *Behaviour Research and Therapy, 43*, 1-14. doi: 10.1016/j.brat.2003.12.002.

Norberg, M. M., Mackenzie, J., & Copeland, J. (2011). Quantifying cannabis use with the timeline followback approach: a psychometric evaluation. *Drug and Alcohol Dependence, 121,* 247-252. doi: 10.1016/j.drugalcdep.2011.09.007

Noyes, R., Garvey, M. J., Cook, B., & Suelzer, M. (1991). Controlled discontinuation of benzodiazepine treatment for patients with panic disorder. *The American Journal of Psychiatry, 148*, 517-523. doi: 10.1176/ajp.148.4.517

Parker, R. N., & Auerhahn, K. (1998). Alcohol, drugs, and violence. *Annual Review of Sociology, 24*, 291-311. doi: 10.1146/annurev.soc.24.1.291

Pierce, M., Hayhurst, K., Bird, S. M., Hickman, M., Seddon, T., Dunn, G., & Millar, T. (2015). Quantifying crime associated with drug use among a large cohort of sanctioned offenders in England and Wales. *Drug and Alcohol Dependence, 155*, 52-59. doi: 10.1016/j.drugalcdep.2015.08.018.

Pierce, M., Hayhurst, K., Bird, S. M., Hickman, M., Seddon, T., Dunn, G., & Millar, T. (2017). Insights into the link between drug use and criminality: Lifetime offending of criminally-active opiate users. *Drug and Alcohol Dependence, 179*, 309-316. doi: 10.1016/j.drugalcdep.2017.07.024

Verster, J. C., & Volkerts, E. R. (2004). Clinical pharmacology, clinical efficacy, and behavioural toxicity of alprazolam: a review of the literature. *CNS Drug Reviews, 10*, 45-76. doi: 10.1111/j.1527-34582004.tb00003.x

Votava, M., Kršiak, M., Podhorna, J., & Miczek, K. (2001). Alprazolam withdrawal and tolerance measured in the social conflict test in mice. *Psychopharmacology, 157*, 123-130. doi: 10.1007/s002130100784

Rapaport, M., & Braff, D. L. (1985). Alprazolam and hostility. *The American Journal of Psychiatry, 142*, 146-146. doi: 10.1176/ajp.142.1.146a

Riordan, K. (2017). *The connection between drug use and crime in Western Australia*. Retrieved from https://ro.ecu.edu.au/theses/1973

Robinson, S. M., Sobell, L. C., Sobell, M. B., & Leo, G. I. (2014). Reliability of the timeline followback for cocaine, cannabis, and cigarette use. *Psychology and Addictive Behaviours, 28,* 154-162. doi: 10.1037/a0030992

Royal Australian College of General Practitioners (2015). *Prescribing drugs of dependence in general practice, Part A: Clinical Governance Framework.* Melbourne: Victoria

Sampasa-Kamyinga, H., Zamorski, M. A., & Colman, I. (2018). The psychometric properties of the 10-item Kessler psychological distress scale (k1-) in Canadian military personnel. *Plos One, 13,* 1-19. doi: 10.1371/journal.pone.0196562

Sampson, R. J., & Laub, J. H. (2003). Desistance from crime over the life course. In *Handbook of the life course* (pp. 295-309). Springer, Boston, MA.

Seddon, T. (2000). Explaining the drug–crime link: Theoretical, policy and research issues. *Journal of Social Policy, 29,* 95-107. doi: 10.1017/S0047279400005833

Smith, B., Miller, P., O'Keefe, B., & Fry, C. (2007). *Benzodiazepine and pharmaceutical opioid misuse and their relationship to crime: an examination of illicit prescription drug markets in Melbourne, Hobart and Darwin: Victorian report* (Doctoral dissertation, Turning Point Alcohol and Drug Centre, Melbourne).

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back. In *Measuring Alcohol Consumption* (pp. 41-72). Humana Press, Totowa, NJ.

Sobell, L. C., Brown, J., Leo, G. I., & Sobell, M. B. (1996). The reliability of the Alcohol Timeline Followback when administered by telephone and by computer. *Drug and Alcohol Dependence, 42,* 49-54. doi: 10.1016/0376-8716(96)01263-x

Sommers, I., & Baskin, D. (2006). Methamphetamine use and violence. *Journal of Drug Issues, 36,* 77-96. doi: 10.1177/002204260603600104

Speckart, G., & Anglin, M. D. (1985). Narcotics and crime: An analysis of existing evidence for a causal relationship. *Behavioural Sciences & the Law, 3,* 259-282. doi: 10.1002/bsl

Strahan, R., & Gerbaski, K. C. (1972). Short, homogeneous versions of the marlow-crowne social desirability scale. *Journal of Clinical Psychology, 28,* 191-193. doi: 10.1002/1097-4679(197204)28:2<191::AID-JCLP2270280220>3.0

Substance Abuse and Mental Health Services Administration. (2013). Drug Abuse Warning Network, 2011: national estimates of drug-related emergency department visits. *HHS Publication No.(SMA) 13-4760, DAWN Series D-39.*

Sutherland, R., Sindicich, N., Barrett, E., Whittaker, E., Peacock, A., Hickey, S., & Burns, L. (2015). Motivations, substance use and other correlates amongst property and violent offenders who regularly inject drugs. *Addictive Behaviours, 45*, 207-213. doi: 10.1016/j.addbeh.2015.01.034

Swartz, J. A., & Lurigio, A. J. (2007). Serious mental illness and arrest: The generalized mediating effect of substance use. *Crime & Delinquency, 53*, 581-604. doi: 10.1177/0011128706288054

Sweeney, J., & Payne, J. (2012). Drug use among police detainees: A comparative analysis of DUMA and the US Arrestee Drug Abuse Monitoring program. *Research in Practice. Canberra: Australian Institute of Criminology*.

Teplin, L. A. (1990). The prevalence of severe mental disorder among male urban jail detainees: comparison with the Epidemiologic Catchment Area Program. *American Journal of Public Health, 80*, 663-669. doi: 10.2105/AJPH.80.6.663.

Wain, T. D., Khong, E., & Sim, M. G. (2007). The prescribing dilemma of benzodiazepines. *Australian Family Physician*, *36*(11), 923. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/18043779

Wallace, P. S., & Taylor, S. P. (2009). Reduction of appeasement-related affect as a concomitant of diazepam-induced aggression: evidence for a link between aggression and the expression of self-conscious emotions. *Aggressive Behaviour: Official Journal of the International Society for Research on Aggression, 35,* 203-212. doi: 10.1002/ab.20294

Weerts, E. M., & Miczek, K. A. (1996). Primate vocalizations during social separation and aggression: effects of alcohol and benzodiazepines. *Psychopharmacology, 127,* 255-264. doi: 10.1007/BF02806001.

White, H. R., & Gorman, D. M. (2000). Dynamics of the drug-crime relationship. *Criminal Justice, 1,* 1-218

Whiteside, S. P., & Lynam, D. R. (2001). The Five Factor Model and impulsivity: using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30,* 669-689. doi: 10.1016/S0191-8869(00)00064-7

Whiteside, S. P., Lynam, D. R., Miller, J. D., & Reynolds, S. K. (2005). Validation of the UPPS impulsive behaviour scale: a four-factor model of impulsivity. *European Journal of Personality, 19,* 559-574. doi: 10.1002/per.556

Wu, L. T., & Anthony, J. C. (2000). The use of the case-crossover design in studying illicit drug use. *Substance Use & Misuse, 35,* 1035-1050. doi:10.3109/10826080009148431

Yoon, I. A., Slade, K., & Fazel, S. (2017). Outcomes of psychological therapies for prisoners with mental health problems: A systematic review and meta-analysis. *Journal of Consulting and Clinical Psychology, 85,* 783. doi: 10.1037/ccp0000214